

REMARKS

INTRODUCTION:

In accordance with the foregoing, the specification has been amended to improved form, claims 32-41 have been canceled without prejudice or disclaimer, claims 1, 2, 13, 14, 18, 25, 30, and 31 have been amended, and claims 42 and 43 have been added.

No new matter is being presented, and approval and entry of the foregoing amendments and new claims are respectfully requested.

Claims 1-31, 42, and 43 are pending and under consideration. Reconsideration is requested.

REJECTION UNDER 35 U.S.C. §112:

In the Office Action at pages 5-6, the Examiner rejects claims 2 and 14 under 35 U.S.C. §112, second paragraph, as being indefinite with regard to the catholyte as the Examiner asserts that it is unclear if the catholyte includes or does not necessarily include Li_2S_n ($n \geq 1$). This rejection is respectfully traversed and reconsideration is requested.

While it is respectfully submitted that one of ordinary skill in the art would have understood the recited catholyte after review of relevant commonly understood definitions, claims 2 and 14 have been amended to clarify the recited catholyte as indicated without narrowing the recited catholyte feature. It is respectfully requested that the Examiner reconsider and withdraw the rejection.

REJECTION UNDER 35 U.S.C. §102:

In the Office Action at pages 6-9, the Examiner rejects claims 1, 2, 5-14, 17-27, 30, and 31 under 35 U.S.C. §102(b) in view of Chu et al. (U.S. Patent No. 6,030,720). This rejection is respectfully traversed and reconsideration is requested.

Among other features and as noted by the Examiner on page 8 of the Office Action, Chu et al. discloses a positive active material of elemental sulfur, sulfides, polysulfides, redox sulfur polymers, and a combination of such sulfur containing materials. (Col. 19, lines 7-13). Chu et al. further discloses a positive current collector in a region 22 which is coextensive with the positive electrode. The current collector is a conductive foam or a conductive matrix such as an expanded metal, or a thin conductive grid such as metal coated polymer fibers or weaves. The positive electrode material is disposed in the matrix created by the current collector. (Col. 9, lines 15-29; FIG. 2B). However, as also acknowledged by the Examiner on page 10 of the Office Action, Chu et al. does not disclose a porosity of the current collector. As such, it is

respectfully submitted that Chu et al. does not disclose the invention recited in claims 1 and 13.

Additionally, in rejecting claim 5, the Examiner on pages 6-7 of the Office Action asserts that the recited “a resin foam coated with a metal, where the coated resin foam is subjected to a pyrolysis process” is not given patentable weight as being a product by process, and interprets the feature as being a porous metallic current collector. However, as noted in MPEP 2113, where the Examiner believes that a limitation is a product by process limitation, the Examiner needs to provide evidence that the resulting structure is disclosed in the prior art. As recited in claim 5, the resulting structure is disclosed as being a resin foam coated with a metal. As such, the Examiner’s interpretation of the structure is unduly broad and does not reflect the invention, as claimed.

Moreover, it is respectfully submitted that the process of pyrolysis results in a structure which should be given patentable weight. Specifically, the pyrolysis process is understood to be a process by which a chemical decomposition occurs due to thermal energy. HAWLEY’S CONDENSED CHEMICAL DICTIONARY, p. 982 (12th Ed. 1993) (“pyrolysis” is “[t]ransformation of a compound into one or more substances by heat alone, i.e., without oxidation.”) As such, it is respectfully submitted that the recitation of the pyrolysis structure defines a type of coated foam structure such that the structure resulting from the pyrolysis process as recited in claim 5 should be given patentable weight.

As such, it is respectfully submitted that Chu et al. does not describe that the conductive foam or conductive matrix of the current collector corresponds to “a resin foam coated with a metal, where the coated resin foam is subjected to a pyrolysis process” as recited in claim 5.

For similar reasons, it is respectfully submitted that Chu et al. does not disclose or suggest a “resin foam coated with a metal” as recited in claim 30.

Lastly, while Chu et al. discloses the use of the conductive foam or conductive matrix as the current collector, there is no suggestion that the conductive foam or matrix includes a conductive agent. As such, it is respectfully submitted that Chu et al. does not disclose or suggest that “said porous current collector comprises a resin foam coated with a metal, where the coated resin foam is subjected to a pyrolysis process” and that “said porous current collector further comprises a conductive agent” as recited in claim 6.

For similar reasons, it is respectfully submitted that Chu et al. does not disclose or suggest the invention recited in claims 17 and 18, or disclose “a positive electrode comprising a current collector having pores and with each pore having a conductive surface, and a positive active mass comprising a sulfur-based active material disposed in the pores contacting the conductive surfaces,” where “the current collector comprises a carbon coated aluminum current

collector" as recited in claim 25.

Claims 2, 7-12, 14, 19-24, 26, 27, and 31 are deemed patentable due at least to their depending from corresponding claims 1, 13, and 25.

In the Office Action at page 9, the Examiner rejects claims 1, 2, 5, 9, 11, 13, 14, 17, 21, 23, and 25-28 under 35 U.S.C. §102(b) in view of Chu (U.S. Patent No. 5,686,201). This rejection is respectfully traversed and reconsideration is requested.

As further confirmed through review of the portions cited in the Office Action, the disclosure of Chu used in the rejection of claims 1, 2, 5, 9, 11, 13, 14, 17, 21, 23, and 25-28 is substantially duplicative of the disclosure of Chu et al. with respect to the rejection of claims 1, 2, 5, 9, 11, 13, 14, 17, 21, 23, and 25-28. Such duplication is generally confirmed by the fact that Chu et al. is a continuation in part of Chu. As such, it is respectfully submitted that Chu does not disclose or suggest the sulfur-based active material and/or the current collector as recited in the invention as recited in claims 1, 2, 5, 9, 11, 13, 14, 17, 21, 23, and 25-28 for reasons similarly set forth above in relation to the rejection of claims 1, 2, 5, 9, 11, 13, 14, 17, 21, 23, and 25-28 in view of continuation in part patent Chu et al.

In the Office Action at page 9, the Examiner rejects claims 1, 2, 5, 9, 11, 13, 14, 17, 21, 23, and 25-27 under 35 U.S.C. §102(e) in view of Barton et al. (U.S. Patent No. 6,503,432). The rejection is traversed and reconsideration is respectfully requested.

By way of review, Barton et al. discloses a lithium-ion battery using anodes having an active material of carbons, metal oxides, or lithium alloy forming compounds. For cathodes, Barton et al. discloses using transition metal oxides such as LiMn_2O_4 , LiNiO_2 , LiCoO_2 , $\text{LiNi}_x\text{Co}_y\text{O}_2$, and vanadium oxides such as LiV_2O_5 , $\text{LiV}_6\text{O}_{13}$. (Col. 9, line 51 to col. 10, line 20). Barton et al. further discloses a support 40 being a current collector of a metal foil, metal coated polymer film, or metal coated filter web. The current collector may be a metal mesh, metal foam, or wire structure. (Col. 12, lines 15-35). However, Barton et al. does not disclose or suggest the porosity as recited in claims 1 and 13. As such, it is respectfully submitted that Barton et al. does not disclose or suggest the invention of claims 1 and 13.

Additionally, Barton et al. does not describe that the metal mesh, metal foam, or wire structure of the current collector corresponds to "a resin foam coated with a metal, where the coated resin foam is subjected to a pyrolysis process" as recited in claim 5.

Lastly, while Barton et al. discloses the use of the metal mesh, metal foam, or wire structure as the current collector, there is no suggestion that the metal mesh, metal foam, or wire structure includes a conductive agent. As such, it is respectfully submitted that Barton et al. does not disclose or suggest that "the porous current collector further comprises a conductive

agent" as recited in claim 17.

For similar reasons, it is respectfully submitted that Barton et al. does not disclose or suggest "a positive electrode comprising a current collector having pores and with each pore having a conductive surface, and a positive active mass comprising a sulfur-based active material disposed in the pores contacting the conductive surfaces," where "the current collector comprises a carbon coated aluminum current collector" as recited in claim 25.

Claims 2, 9, 11, 14, 21, 23, 26, and 27 are deemed patentable due at least to their depending from corresponding claims 1, 13, and 25.

REJECTION UNDER 35 U.S.C. §103:

In the Office Action at pages 9-10, the Examiner rejects claims 3, 4, 15, 16, and 29 under 35 U.S.C. §103 in view of Chu et al. and Palmer (U.S. Patent No. 4,508,608). The rejection is respectfully traversed and reconsideration is requested.

The Examiner acknowledges that Chu et al. does not teach a porosity of the current collector, and instead relies on Palmer as disclosing a specific porosity. However, as also acknowledged by the Examiner, Palmer teaches a porosity of 90 to 97% porosity. In contrast, claim 1 recites, among other features, "a current collector having pores comprising at or greater than 60% porosity and less than 90% porosity based on an overall volume of said current collector." Since claims 3 and 4 depend from claim 1, it is respectfully submitted that the large porosity disclosed by Palmer exceeds the porosity as recited in claims 1, 3, and 4. Moreover, when the porosity exceeds 90% in the manner suggested by Palmer, an efflux of the slurry of the active material among the pores during a wet coating of the current collector occurs, which results in a decrease in an amount of the active material filled in the current collector. The larger porosity also results in a reduced amount of electrical conductivity otherwise provided by the current collector due to a decreased surface area available for such conductivity as well as making the collector structurally weaker, making the collector more difficult to handle. The decrease in the amount of the active material and surface area therefore at the porosity suggested in Palmer therefore results in a decreased capacity and usability of the resulting battery as compared to the recited invention in claims 1, 3, and 4. Thus, it is respectfully submitted that the combination of Chu et al. and Palmer does not disclose or suggest the invention recited in claims 1, 3, and 4.

For at least similar reasons, it is respectfully submitted that the combination of Chu et al. and Palmer does not disclose or suggest the invention recited in claims 13, 15, and 16.

Lastly, even assuming arguendo that the Examiner's construction of Palmer is correct

and that there is a motivation to make such a combination, it is therefore respectfully submitted that the combination of Chu et al. and Palmer does not disclose or suggest the invention recited in claim 29 due at least to the combination not disclosing or suggesting the invention recited in claim 25.

PATENTABILITY OF NEW CLAIMS:

Claims 42-43 are deemed patentable due at least to their depending from claim 25.

CONCLUSION:

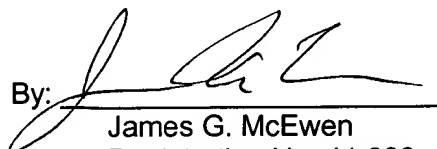
In accordance with the foregoing, it is respectfully submitted that all outstanding objections and rejections have been overcome and/or rendered moot. And further, it is respectfully submitted that all pending claims patentably distinguish over the prior art. Thus, there being no further outstanding objections or rejections, the application is submitted as being in condition for allowance which action is earnestly solicited.

If the Examiner has any remaining issues to be addressed, it is believed that prosecution can be expedited by the Examiner contacting the undersigned attorney for a telephone interview to discuss resolution of such issues.

If there are any additional fees associated with the filing of this Amendment, please charge the same to our Deposit Account No. 19-3935.

Respectfully submitted,

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